Radiation Report on **AD7846SQ (DC: Q0408A)**
Project: AIM

A radiation evaluation was performed on **The AD7846SQ (Analog Devices)** is a **16-Bit Voltage Output DAC** to determine the total dose tolerance of these parts. The total dose testing was performed using a Co^{60} gamma ray source. During the radiation testing, six five were irradiated under bias, see figure 1. One part was used as a control sample,. The total dose radiation levels were 1, 5, 10, 15, and 20kRads(Si). The average dose rate was 0.49 rads (Si)/sec. After the 20krad(Si) irradiation, the parts were annealed under bias at 25°C for 168 hours. After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits listed in Table III. An executive summary of the test results is provided below in bold, followed by a detailed summary of the test results after each radiation level and annealing step.

All devices met datasheet specifications to 5krads (Si). At 10 krads (Si) the devices had an average DNL of 1040.2971LSB. At 15 krads (Si) all devices ceased functioning. The devices were then annealed. After the devices were annealed DUT2 & DUT5 exceeded the datasheet specifications of ±1 LSB for DNL by 0.8349 & -2.6262. LSB. The devices were exposed to an additional 5 krads (Si), brining the total to 20 krads(Si). At this point all the devices still continued to meet the manufacturer's specifications. The devices were exposed to another 5 krads (Si), at witch point DUT3, DUT34 & DUT5 exceeded the ±LSB DNL specification by 0.8349, 19.7128, & -81.9389 LSB.

Initial electrical measurements were made on 6 samples. five samples were irradiated (1, 2, 3, 4, 5)) and device number C was used as a control sample, but due to an oversight of the test engineer. All devices had the following external markings on the package: 5962-2369701XA; AD7846SQ/883B; Q0408A

All devices experienced met the manufacturer's datasheet specifications prior to radiation.

Table IV provides a summary of the test results with the mean and standard deviation values for each parameter after each irradiation exposure and annealing step.

TABLE I. Part Information

Generic Part Number:	AD7846SQ
Full Part Number	5962-8969701XA
Manufacturer:	Analog Devices
Lot Date Code (LDC):	Q0408A
Quantity Tested:	6
Serial Numbers of Control Sample:	6
Serial Numbers of Radiation Samples:	1, 2, 3, 4, 5
Part Function:	DAC
Part Technology:	CMOS
Package Style:	20 pin dip
Test Equipment:	HP4156B Precision Semiconductor Parameter Analyzer; HP E3611A DC Power Supply
Test Engineer:	C. Palor / A. Pham

- The manufacturer for this part guaranteed no radiation tolerance/hardness.

TABLE II. Radiation Schedule for AD7846SQ

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	01/04/05
2) 1 KRAD IRRADIATION (0.23 RADS (Si)/SEC)	2/8/2005
POST-1 KRAD ELECTRICAL MEASUREMENT	2/8/2005
3) 5 KRAD IRRADIATION (0.07 RADS (Si)/SEC)	2/9/2005
POST-5 KRAD ELECTRICAL MEASUREMENT	2/9/2005
4) 10 KRAD IRRADIATION (1.45 RADS (Si)/SEC)	2/9/2005
POST-10 KRAD ELECTRICAL MEASUREMENT	2/9/2005
5) 15 KRAD IRRADIATION (0.08 RADS (Si)/SEC)	2/10/2005
POST-15 KRAD ELECTRICAL MEASUREMENT	2/10/2005
6) 20 KRAD IRRADIATION (0.61 RADS (Si)/SEC)	2/22/2005
POST-20 KRAD ELECTRICAL MEASUREMENT	2/22/2005
7) 25 KRAD IRRADIATION (0.08 RADS (Si)/SEC)	2/23/2005
POST-25 KRAD ELECTRICAL MEASUREMENT	2/23/2005

Average Dose Rate = 0.49 rads (Si)/sec

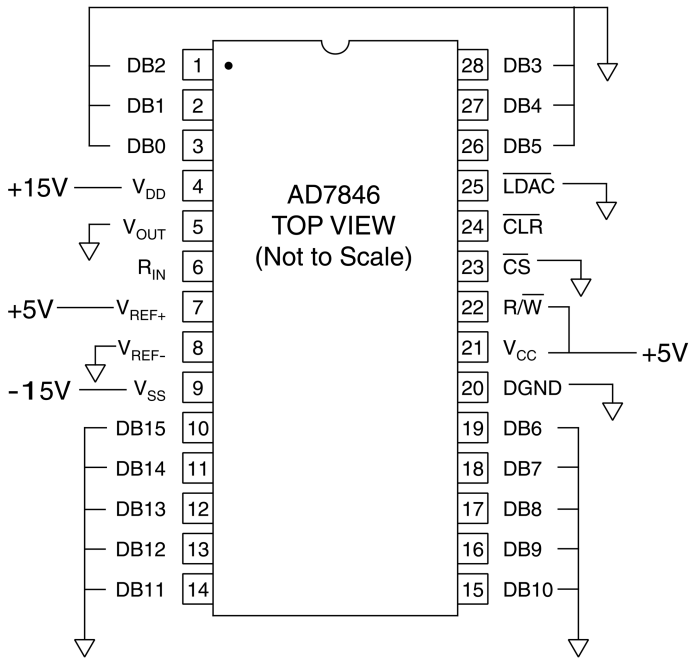

Figure 1. AD7846SQ Bias Circuit

Table III. Electrical Characteristics AD7846SQ

						Total Dose Exposure (kRads Si)										Annealing		Additional Dose After Annealing (kRads Si)			
				Spec. Lim. (2)		Initial		1 krad (Si)		5 krads (Si)		10 krads (Si)		15 krads (Si)		168 hours @25°C		5 krads (Si) total		10 krads (Si) total	
Test #	Parameters	Condition	Units	min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	INL	VDD = 5V, VCC = +4.75 V to +5.25 V.	LSB			0.001	8.22E-04	0.001	8.22E-04	0.012	6.36E-03	6.136	5.32E+00	NA	NA	0.000	7.86E-04	-0.003	6.96E-03	0.104	9.40E-02
2	DNL	VDD = 5V, VCC = +4.75 V to +5.25 V.	LSB	-1	+1 LSB	-0.677	4.52E-03	-0.677	4.52E-03	-0.665	2.62E-02	1040.297	4.20E+03	NA	NA	-0.385	1.99E+00	-0.015	8.60E-04	-18.631	3.77E+01
3	Off_{err}	VDD = 5V, VCC = +4.75 V to +5.25 V.	LSB	-24 LSB	+24 LSB	-0.419	9.41E-01	-0.516	8.75E-01	3.076	5.64E+00	2.770	4.11E+00	NA	NA	3.113	5.50E+00	-0.930	7.43E-02	-1.292	8.44E-01